Claims:

1. A chamber shield assembly for a semiconductor-wafer vacuum processing apparatus comprising:

a plurality of shields made of high thermal conductivity material to provide high thermal conductivity throughout each shield;

each shield having a mounting surface configured to provide intimate thermal contact with the wall of a chamber of the apparatus when secured thereto, the mounting surface having sufficient area to provide high thermal conductivity between the shield and the wall of the chamber.

2. The shield assembly of claim **1** wherein:

the shields have a common axis and generally circular, annular cross sections in planes perpendicular to the axis; and

the mounting surfaces having an area that provides the intimate thermal contact that is at least as large as the area of the cross sections of the respective shields.

3. The shield assembly of claim **2** wherein:

the mounting surfaces provide a thermal conductivity between the shields and the chamber wall that is at least as great as the thermal conductivity across said cross sections of the respective shields.

4. The shield assembly of claim **3** wherein:

the shields are configured to mount in a cooperating relationship, when installed in the chamber, out of contact with each other and spaced by gaps sufficient to avoid arcing; and

the gaps are dimensioned, and the mounting surfaces are located in relation to the gaps, such that the gaps remain sufficient to avoid arcing during any likely thermal expansion of the shields.

5. The shield assembly of claim **1** wherein:

the shields are configured to mount in a cooperating relationship, when installed in the chamber, out of contact with each other and spaced by gaps sufficient to avoid arcing; and

the gaps are dimensioned, and the mounting surfaces are located in relation to the gaps, such that the gaps remain sufficient to avoid arcing during any likely thermal expansion of the shields.

6. A wafer processing apparatus comprising:

a vacuum chamber bounded by a temperature controlled chamber wall;

a chamber shield assembly that includes:

a plurality of shields formed of high thermal conductivity material;

each shield having a mounting surface connected in intimate thermal contact with the wall of a chamber, the mounting surface having area so as to provide high thermal conductivity between the shield and the wall of the chamber.

7. The apparatus of claim **6** wherein:

the shields have a common axis and generally circular, annular cross sections in planes perpendicular to the axis; and

the mounting surfaces having an area that provides the intimate thermal contact that is at least as large as the area of the cross sections of the respective shields.

8. The apparatus of claim **7** wherein:

the mounting surfaces provide a thermal conductivity between the shields and the chamber wall that is at least as great as the thermal conductivity across said cross sections of the respective shields.

9. The apparatus of claim **8** wherein:

the shields are mounted in a cooperating relationship, out of contact with each other and spaced by gaps sufficient to avoid arcing; and

the gaps are dimensioned, and the mounting surfaces are located in relation to the gaps, such that the gaps remain sufficient to avoid arcing during any likely thermal expansion of the shields.

10. The apparatus of claim **6** wherein:

the shields are mounted in a cooperating relationship, out of contact with each other and spaced by gaps sufficient to avoid arcing; and

the gaps are dimensioned, and the mounting surfaces are located in relation to the gaps, such that the gaps remain sufficient to avoid arcing during any likely thermal expansion of the shields.

11. The apparatus of claim **10** further comprising:

cooperating alignment structure on the shields and on the chamber wall configured to locate the shields in the cooperating relationship when installed in the chamber.

12. The apparatus of claim **6** further comprising:

an array of radiant heaters spaced around the chamber so as to enable the direction of radiant heating onto extended surfaces of a plurality of the shields of the assembly.

13. The apparatus of claim **6** further comprising:

an array of radiant lamps oriented parallel to the axis of the chamber and spaced around the chamber so as to enable the direction of radiant heating onto extended surfaces of a plurality of the shields of the assembly.

14. A method of reducing the flaking of deposits from chamber shields within a semiconductor wafer processing chamber, comprising:

installing in the chamber a chamber shield assembly that includes a plurality of shields made of high thermal conductivity material;

the installing including mounting each shield to a wall of the chamber such that a mounting surface thereof provides intimate thermal contact with the wall of a chamber across sufficient area to provide high thermal conductivity between each shield and the wall of the chamber.

15. The method of claim **14** wherein:

the mounting of the shields includes aligning the shields on a common axis; and

the area of the mounting surface having an area of intimate thermal contact that is at least as large as the cross-sectional area of the respective shields perpendicular to the axis.

16. The method of claim **14** wherein:

the mounting of the shields includes aligning the shields in a cooperating relationship, out of contact with each other and spaced by gaps sufficient to avoid arcing during any likely thermal expansion of the shields.

17. The method of claim **16** wherein:

the mounting of the shields in the chamber includes aligning cooperating alignment structure on the shields and on the chamber wall to locate the shields in the cooperating relationship in the chamber.

18. An improved processing apparatus, wherein the processing apparatus comprises a vacuum chamber bounded by a chamber wall, an upwardly facing substrate support, an ionized sputter material source, the chamber wall includes a fixed lower portion and a top portion which sits on the chamber wall rim at the open top of the lower portion, where it forms a vacuum seal and a thermal and electrical flow path to the lower portion, and the source is mounted on the top portion of the chamber wall, the improvement comprising:

a cylindrical barrel shield comprising a flange and a body portion and being coupled to a lower chamber wall using the flange;

a cylindrical upper source shield comprising a top ring, a sloped ring, bottom ring, and mounting element and being coupled to an upper chamber wall using the mounting element; and

a cylindrical lower shield comprising a top ring, body portion, and bottom ring and being coupled to the lower chamber wall using the body portion.

19. The improved processing apparatus as claimed in claim **18**, wherein the improvement further comprises a table shield including a top ring, a body portion, and a bottom ring and being coupled to the substrate support using the top ring.

20. A barrel shield comprising:

a cylindrical element comprising a flange and body portion, wherein the flange has a top surface, an outside surface coupled to the top surface, and a bottom surface coupled to the outside surface, wherein the body portion has an inner surface coupled to the top surface of the flange, an outer surface coupled to the bottom surface of the flange, and a bottom surface coupled to the inner surface and the outer surface.

21. The barrel shield as claimed in claim **20**, wherein the cylindrical element is fabricated from a single block of material.

22. The barrel shield as claimed in claim **20**, wherein the flange comprises a plurality of cutouts in a radial pattern and extending from the top surface to the bottom surface.

23. The barrel shield as claimed in claim **20**, wherein the flange comprises a slot extending from the top surface to the bottom surface.

24. The barrel shield as claimed in claim **23**, wherein the slot is located on a circle having a diameter of at least approximately 630 mm.

25. The barrel shield as claimed in claim **23**, wherein the slot has an angular displacement of at least approximately 16.3 degrees.

26. The barrel shield as claimed in claim **23**, wherein the slot has a length of at least approximately 4 mm, a width of at least approximately 4.9 mm, and has curved ends having radiuses of at least approximately 2.45 mm.

27. The barrel shield as claimed in claim **20**, wherein the flange comprises at least one alignment feature extending from the top surface to the bottom surface.

28. The barrel shield as claimed in claim **27**, wherein the alignment feature is located on the outer edge of flange, has a length of approximately 30.0 mm, and a depth of approximately 17.9 mm.

29. The barrel shield as claimed in claim **20**, wherein the flange comprises a number of through-holes extending from the top surface to the bottom surface and having a diameter of at least approximately 0.8??? mm.

30. The barrel shield as claimed in claim **29**, wherein the through-holes are located on a circle having a diameter of approximately 634 mm and have angular displacements of approximately 16.3 degrees, approximately 21.2 degrees, and approximately 90 degrees.

31. The barrel shield as claimed in claim **20**, wherein the flange comprises at least one slot extending from the top surface to the bottom surface that can be located on a circle having a diameter of at least approximately 630 mm.

32. The barrel shield as claimed in claim **31**, wherein the at least one slot has an angular displacement of at least approximately 16.3 degrees, a length of at least approximately 4 mm, and a width of at least approximately 4.9 mm.

33. The barrel shield as claimed in claim **20**, wherein the inner surface, bottom surface, at least a portion of an outer surface, and at least a portion of a top surface of the flange are grit blasted.

34. The barrel shield as claimed in claim **20**, wherein the inner surface, bottom surface, at least a portion of an outer surface of the body portion, and at least a portion of a top surface of the flange are arc sprayed.

35. The barrel shield as claimed in claim **20**, wherein the inner surface, bottom surface, at least a portion of an outer surface of the body portion, and at least a portion of a top surface of the flange are coated using at least one of Al_2O_3, Yttria (Y_2O_3), Sc_2O_3, Sc_2F_3, YF_3 , La_2O_3, CeO_2, Eu_2O_3, and DyO_3.

36. An upper source shield comprising:

a cylindrical element comprising a top ring, a sloped ring, bottom ring, and mounting element, wherein the top ring comprises inner surface, top surface, and an outer surface; sloped ring portion comprises an inner surface coupled to the inner surface of the top ring, and an outer surface coupled to the outer surface of the top ring; bottom ring comprises inner surface coupled to the inner surface of the sloped ring, an outer surface coupled to the outer surface of sloped ring, and a bottom surface coupled to the inner surface and the outer surface; and mounting element comprises a mating surface coupled to the outer surface of the sloped ring, an outer surface coupled to the top surface and the bottom surface of the mounting element, and a lower surface coupled to the bottom surface of the mounting element and the outer surface of bottom ring.

37. The upper source shield as claimed in claim **36**, wherein the cylindrical element is fabricated from a single block of material.

38. The upper source shield as claimed in claim **37**, wherein the material is aluminum (6061-T6).

39. The upper source shield as claimed in claim **36**, wherein the upper source shield comprises a height of at least approximately 116.4 mm.

40. The upper source shield as claimed in claim **36**, wherein the mounting element comprises a number of through-holes extending from the mating surface to the bottom surface, wherein each through-hole has a diameter of at least approximately 25.4 mm.

41. The upper source shield as claimed in claim **36**, wherein the through-holes are located on a circle having a diameter of approximately 560 mm, and have angular displacements of approximately 40.3 degrees and approximately 90 degrees.

42. The upper source shield as claimed in claim **36**, wherein the mounting element comprises at least one slot extending from the mating surface to the bottom surface, wherein the slot is located on a circle having a diameter of approximately 584.7 mm and has an angular displacement of approximately 37.5 degrees.

43. The upper source shield as claimed in claim **36**, wherein the slot has a length of at least approximately 4 mm, and a width of at least approximately 5 mm.

44. The upper source shield as claimed in claim **36**, wherein the mounting element comprises at least one hole extending from the mating surface to the bottom surface, wherein the hole is located on a circle having a diameter of at least approximately 586.7 mm and has a diameter of approximately 5 mm.

45. The upper source shield as claimed in claim **36**, wherein the top ring comprises an inside diameter of at least approximately 372.8 mm and an outside diameter of at least approximately 380.9 mm.

46. The upper source shield as claimed in claim **36**, wherein the sloped ring comprises an angular displacement of approximately 124.5 degrees.

47. The upper source shield as claimed in claim **36**, wherein the bottom ring comprises an outside diameter of approximately 567 mm and a thickness of at least approximately 6.3 mm.

48. The upper source shield as claimed in claim **36**, wherein the mounting element comprises an outside diameter of at least approximately 605.0 mm and a thickness of at least approximately 6.3 mm.

49. The upper source shield as claimed in claim **36**, wherein the inner surface, top surface, and at least a portion of an outer surface of top ring; the inner surface of sloped ring portion; and the inner surface, outer surface, and bottom surface of bottom ring are grit blasted.

50. The upper source shield as claimed in claim **37**, wherein the inner surface of sloped ring portion, and the inner surface, the outer surface, and the bottom surface of bottom ring are arc sprayed.

51. The upper source shield as claimed in claim **37**, wherein the inner surface of sloped ring portion, and the inner surface, the outer surface, and the bottom surface of bottom ring are coated using at least one of Al_2O_3, Yttria (Y_2O_3), Sc_2O_3, Sc_2F_3, YF_3 , La_2O_3, CeO_2, Eu_2O_3, and DyO_3.

52. An lower shield comprising:

a cylindrical element comprising a top ring, body portion, and bottom ring, wherein the top ring comprises an inner surface, a top surface, and an outer surface; body portion comprises a top surface coupled to the inner surface of top ring and to the inner surface of bottom ring, a outer surface coupled to the outer surface of the top ring and to the outer surface of the bottom ring; and bottom ring comprises a bottom surface coupled to the inner surface and the outer surface of the bottom ring.

53. The lower shield ring as claimed in claim **52**, wherein the body portion comprises at least one through-hole extending from the top surface to the bottom surface, the hole having a diameter of approximately 12.0 mm and being located on a circle 664 having a radius of approximately 241.5 mm.

54. The lower shield ring as claimed in claim **52**, wherein the top ring comprises a number of holes, the holes being located on a circle having a radius of at least approximately 301.3 mm and having a diameter of at least approximately 6.5 mm.

55. The lower shield ring as claimed in claim **52**, wherein the top ring comprises a plurality of through-holes, the through-holes being located on a circle having a radius of approximately 301.3 mm, having a diameter of approximately 4.3 mm, and being spaced apart at a distance of approximately 20.0 mm.

56. The lower shield ring as claimed in claim **52**, wherein the top ring comprises an inside diameter of approximately 592.7 mm and an outside diameter of approximately 612.7 mm.

57. The lower shield ring as claimed in claim **52**, wherein the bottom ring comprises an inside diameter of approximately 355.0 mm and a thickness of approximately 6.3 mm.

58. The lower shield ring as claimed in claim **52**, wherein the top ring comprises a height of approximately 28.6 mm.

59. The lower shield ring as claimed in claim **52**, wherein the bottom ring comprises thickness of approximately 6.3 mm and a height of approximately 15.8 mm.

60. The lower shield ring as claimed in claim **52**, wherein the cylindrical element is fabricated from a single block of material.

61. The lower shield ring as claimed in claim **60**, wherein the material is aluminum (6061-T6).

62. The lower shield ring as claimed in claim **52**, wherein the inner surface, and top surface of the top ring; the top surface and at least a portion of the bottom surface of body portion; the interior surfaces of the hole; and the inner surface and the bottom surface of the bottom ring are grit blasted.